

SMALL ENGINE TECHNOLOGY

Curriculum Content Frameworks

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Curriculum Content Framework

SMALL ENGINE TECHNOLOGY

Grade Levels: 10, 11, 12
Course Code: 491350

Prerequisites: Agriculture Science & Technology or Agriculture Science

Course Description: This course examines the uses of small engines in all areas of agriculture. Selection, maintenance and repair, and employability are major topics.

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Unit 1: Small Engines in Agriculture

5 Hours

Terminology: ATV, Carbon monoxide, CDE, EETC, Entrepreneur, ESA, Federal Clean Air Act, Fire extinguishers, Flammable, Flash point, Four-cycle engine, General manager, Hydrogen gas, Lawn garden and field equipment, LPG, OPE, OSHA, Personal watercraft, Rotary mower, SAE, Sales manager, Sales representative, Service manager, Service technician, Solvent, Toxic fumes, Two-cycle engine, Ventilation, Volatility

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
1.1 Define terms		Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
1.2 Identify uses of small gas engines in the agricultural industry		Foundation	Listening	Comprehends ideas and concepts related to small gas engines [1.2.1] Listens for content [1.2.3]
			Speaking	Asks questions to obtain information [1.5.4] Participates in conversation, discussion, and group presentations [1.5.8]
		Thinking	Reasoning	Sees relationship between two or more ideas, objects, or situations [4.5.5]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
1.3 List safety precautions that should be taken when working with small engines	1.3.1 View a video showing the proper use of small engines and safety precautions that should be followed	Foundation	Listening	Listens for conversation [1.2.3] Listens to follow directions [1.2.6] Receives and interprets verbal messages [1.2.8]
		Personal Management	Integrity/Honesty/Work Ethic	Complies with safety and health rules in a given work environment [3.2.2] Follows established rules, regulations, and policies [3.2.5]
1.4 Discuss careers in agriculture that require knowledge of small engines	1.4.1 Research a career in small engines to determine the education requirements, working conditions, and salary	Foundation	Reading	Applies information to job performance [1.3.4] Uses standard occupational resource materials [1.3.22]
		Personal Management	Career Awareness, Development, & Mobility	Develops skills to locate, evaluate, and interpret career information [3.1.4] Explores career opportunities [3.1.6] Identifies education and training needed to achieve goals [3.1.8]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
1.5 Identify FFA opportunities for students interested in small engines		Foundation	Speaking	Participates in conversation, discussion, and group presentations [1.5.8] Uses verbal language and other cues, such as body language, appropriate in style, tone, and level of complexity to the audience and the occasion [1.5.14]
		Personal Management	Career Awareness, Development, & Mobility	Comprehends ideas and concepts related to students interested in small engines [3.1.3] Establishes and implements a plan of action [3.1.5] Sets well-defined and realistic personal/career goals (short-term and long-term) [3.1.11]

Unit 2: Small Engine Tools

5 Hours

Terminology: Box-end wrench, Center punch, Compression gauge, Dial indicator, Drift punch, Feeler gauge, Flywheel holder, Gear puller, Impact driver, Impact wrench (air), Machinist's vise, Micro-depth gauge, Multimeter, Open-end wrench, Pin punch, Prick punch, Probe and pick-up tool, Retaining ring pliers, Ring compressor, Screw pitch gauge, Standard micrometer, Tachometer, Telescoping gauges, Torque wrench, Vernier caliper, Vernier micrometer, Value spring compressor

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
2.1 Define terms		Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
2.2 Explain why special tools are needed when working on small engines		Foundation	Reading	Applies information and concepts derived from printed materials [1.3.3] Applies information to job performance [1.3.4] Applies/Understands technical words that pertain to subject [1.3.6]
		Personal Management	Responsibility	Exerts a high level of effort and perseverance toward goal attainment [3.4.4] Maintains a high level of concentration in completion of a task [3.4.7]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
2.3 Identify small engine measuring tools and their uses	2.3.1 Demonstrate the ability to use an inside micrometer	Foundation	Reading	Identifies relevant details, facts, and specifications [1.3.16] Interprets drawings to obtain factual information [1.3.17] Uses appropriate materials and techniques as specified [1.3.20]
		Personal Management	Organizational Effectiveness	Applies knowledge to implement work-related system or practice [3.3.4] Identifies characteristics desired by organization [3.3.6] Presents personal skills as benefits for company objective [3.3.7]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
2.4 Describe tools used in the operation, maintenance, and repair of small engines	2.4.1 Demonstrate the ability to fit tools associated with small engines	Foundation	Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2] Pronounces words correctly [1.5.9] Responds to listener feedback [1.5.10]
		Personal Management	Responsibility	Comprehends ideas and concepts related to small engine tools [3.4.2] Exhibits enthusiasm in approaching and completing tasks [3.4.3] Pays close attention to details [3.4.8]

Unit 3: Engine Identification & Inspection

3 Hours

Terminology: BDC, Bore, CID, Combustion, Cycle, Friction, Horizontal crankshaft, Horsepower, Kinetic energy, Model number, Piston displacement, PSI, Reciprocating motion, Score, Service manual, Stroke, TDC, Torque, Transmission, Vertical crankshaft

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
3.1 Define terms		Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
3.2 Compare the characteristics of two-cycle and four-cycle engines		Foundation	Reading	Comprehends written specifications and applies them to a task [1.3.9] Locates pertinent information in documents, such as manuals, graphs, and schedules, to perform tasks [1.3.18]
		Thinking	Decision Making	Evaluates information/data to make best decision [4.2.5]
3.3 Explain the types of information found on the small engine nameplate	3.3.1 Locate model, type, code, and specification information on a nameplate	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6] Identifies relevant details, fact, and specifications [1.3.16]
		Thinking	Seeing Things in the Mind's Eye	Organizes and processes images—symbols, pictures, graphs, objects, etc. [4.6.2]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
3.4 Identify crankshaft operating position		Foundation	Reading	Applies information to job performance [1.3.4]
				Reads and follows instructions to operate technical equipment [1.3.19]
		Thinking	Problem Solving	Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]
				Interprets drawings to solve design problems [4.4.7]

Unit 4: Principles of Operation of Four-Cycle Engines

5 Hours

Terminology: Armature gap, Camshaft, Crankcase, Crankcase breather, Crosshatch, Exhaust stroke, Flywheel magnet, Governor, Intake stroke, Oil sump, Overhead valve system, Piston ring, Power stroke, Tappet, Timing marks, Valve guides

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
4.1 Define terms		Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
4.2 Identify the major engine components and their functions		Foundation	Writing	Applies/Uses technical words and concepts [1.6.4] Summarizes written information [1.6.17] Uses technical words and symbols [1.6.20]
		Thinking	Knowing how to Learn	Develops personal learning strategies—note-taking, clustering related items, flash cards, etc. [4.3.2] Processes new information as related to workplace [4.3.5]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
4.3 Analyze the strokes of a four-cycle engine		Foundation	Listening	Receives and interprets verbal messages [1.2.8] Responds nonverbally to conversation [1.2.9]
		Interpersonal	Teamwork	Demonstrates understanding, friendliness, adaptability, empathy, and politeness in new and ongoing group settings [2.6.3] Takes an interest in what others say and do [2.6.5]
4.4 Distinguish between valve arrangement patterns	4.4.1 Analyze valve timing with respect to crankshaft rotation	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6] Interprets drawings to obtain factual information [1.3.17] Reads and follows instructions to operate technical equipment [1.3.19]
		Thinking	Reasoning	Applies rules and principles to a new situation [4.5.1] Sees relationship between two or more ideas, objects, or situations [4.5.5]

Unit 5: Small Engine Systems

17 Hours

Terminology: Babbitt, Centrifugal, Choke, Condenser, Conduction, Cooling fins, Diaphragm carburetors, Dwell, Ejection pump system, Float needle valve, Fuel pump, Hand primer, Idle adjusting needle, Ignition coil, Solid state ignition, Spark plug reach, Splash lubrication, Throttle valve, Venturi, Viscosity

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.1 Define terms		Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
5.2 Compare breaker points and electronic ignition systems	5.2.1 Demonstrate the ability to service applicable ignition systems	Foundation	Science	Applies a scientific principle to solve a problem [1.4.8]
		Interpersonal	Customer Service	Works with customers to satisfy their expectations [2.3.9]
5.3 Identify engine components associated with lubrication		Foundation	Reading	Adjusts reading strategy to purpose and type of reading (skimming and scanning) [1.3.1]
				Applies information to job performance [1.3.4]
		Thinking	Creative Thinking	Combines ideas or information in new way [4.1.2]
				Makes connections between seemingly unrelated ideas [4.1.6]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.4 Describe various types of lubrication systems	5.4.1 Demonstrate the ability to check level of lubricant and add lubricant if needed	Foundation	Speaking	Communicates a thought, idea, or fact in spoken form [1.5.5]
	5.4.2 Demonstrate the ability to change engine oil and filter			Uses verbal language and other cues, such as body language, appropriate in style, tone, and level of complexity to the audience and the occasion [1.5.14]
	5.4.3 Demonstrate the ability to service the crankcase breather	Personal Management	Responsibility	Accepts responsibility of position [3.4.1] Exhibits enthusiasm in approaching and completing tasks [3.4.3] Sets high standards for self in completion of a task [3.4.9]
5.5 Identify types of starting systems		Foundation	Reading	Identifies relevant details, facts, and specifications [1.3.16] Interprets drawings to obtain factual information [1.3.17]
		Thinking	Knowing how to Learn	Locates appropriate learning resources to acquire or improve knowledge and skills [4.3.3] Processes new information as related to workplace [4.3.5]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.6 List parts of a recoil starter system and their functions	5.6.1 Demonstrate the ability to serve the recoil starting system	Foundation	Reading	Locates pertinent information in documents, such as manuals, graphs, and schedules, to perform tasks [1.3.18] Uses appropriate materials and techniques as specified [1.3.20]
		Personal Management	Organizational Effectiveness	Identifies characteristics desired by organization [3.3.6] Presents personal skills as benefits for company objective [3.3.7]
5.7 Identify the components of a charging system and their functions	5.7.1 Demonstrate the ability to service the charging system	Foundation	Listening	Evaluates oral information/presentation [1.2.2] Listens to follow directions [1.2.6] Responds nonverbally to conversation [1.2.9]
		Thinking	Problem Solving	Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5] Identifies possible reasons for problem [4.4.6]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.8 List the types of cooling systems		Foundation	Writing	Adapts notes to a proper form [1.6.1] Applies/Uses technical words and concepts [1.6.4] Writes/Prints legibly [1.6.24]
		Thinking	Seeing Things in the Mind's Eye	Imagines the flow of work activities from narrative descriptions [4.6.1] Visualizes a system's operation from schematics [4.6.3]
5.9 Identify the components of an air-cooled system and their functions	5.9.1 Demonstrate the ability to service an air-cooled system	Foundation	Reading	Adjusts reading strategy to purpose and type of reading (skimming and scanning) [1.3.1] Determines what information is needed [1.3.10] Uses appropriate materials and techniques as specified [1.3.20]
		Thinking	Reasoning	Uses logic to draw conclusions from available information [4.5.6]
			Seeing Things in the Mind's Eye	Organizes and processes images—symbols, pictures, graphs, objects, etc. [4.6.2]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.10 Identify the different types of carburetors used on small gas engines	5.10.1 Demonstrate the ability to rebuild a carburetor	Foundation	Speaking	Asks questions to clarify information [1.5.3] Asks questions to obtain information [1.5.4] Speaks effectively, using appropriate eye contact, gestures, and posture [1.5.11]
		Thinking	Decision Making	Demonstrates decision-making skills [4.2.4] Evaluates information/data to make best decision [4.2.5]
5.11 List the components of a fuel system and their functions	5.11.1 Demonstrate the ability to service the fuel system	Foundation	Writing	Applies/Uses technical words and concepts [1.6.4] Uses technical words and symbols [1.6.20]
		Interpersonal	Teamwork	Contributes to group with ideas, suggestions, and effort [2.6.2] Takes an interest in what others say and do [2.6.5] Works effectively with others to reach a common goal [2.6.6]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.12 List the types of governor systems		Foundation	Reading	Analyzes and applies what has been read to specific task [1.3.2] Comprehends written information for main ideas [1.3.7]
		Thinking	Knowing how to Learn	Processes new information as related to workplace [4.3.5]
5.13 Identify the components of governor systems and their functions	5.12.1 Demonstrate the ability to service the governor system	Foundation	Reading	Locates pertinent information in documents, such as manuals, graphs, and schedules to perform tasks [1.3.18] Reads and follows instructions to operate technical equipment [1.3.19] Uses appropriate materials and techniques as specified [1.3.20]
		Thinking	Creative Thinking	Finds new ways of dealing with existing problems/situations [4.1.5] Makes connections between seemingly unrelated ideas [4.1.6]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.14 Explain the function of the exhaust system		Foundation	Writing	Communicates thoughts, ideas, or facts in written form in a clear, concise manner [1.6.6] Organizes sentences into paragraphs [1.6.11] Writes logical and understandable sentences [1.6.23]
		Thinking	Reasoning	Sees relationship between two or more ideas, objects, or situations [4.5.5]
5.15 Discuss hazards associated with exhaust systems	5.15.1 Demonstrate the ability to service an exhaust system	Foundation	Speaking	Organizes ideas, and communicates oral messages to listeners [1.5.7] Pronounces words correctly [1.5.9] Responds to listener feedback [1.5.10]
		Personal Management	Integrity/Honesty/Work Ethic	Complies with safety and health rules in a given work environment [3.2.2] Describes desirable worker characteristics [3.2.3]

Unit 6: Troubleshooting

10 Hours

Terminology: Air breather, Antifreeze, Clearances, Compression test, Condensation, Crankcase breather, Dipstick, Loaded oil, Muffler, Orifice, Preventive maintenance, Stroboscope, Tolerances, Torque specifications

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
6.1 Define terms		Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
6.2 List the steps in troubleshooting an engine	6.2.1 Demonstrate the ability to troubleshoot an engine	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6] Locates pertinent information in documents, such as manuals, graphs, and schedules, to perform tasks [1.3.18]
		Thinking	Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2] Draws conclusions from what is read, and gives possible solutions [4.4.4] Draws conclusions from observations [4.4.5] Evaluates conditions, and gives possible solutions [4.4.8]

Unit 7: Overhauling & Rebuilding the Four-Cycle Engine

35 Hours

Terminology: Antifriction bearings, Cylinder gauge, Cylinder sleeve, Cylinder taper, End gap, Friction bearings, Honing, Inside micrometer, Lands, Overhead valve system, Reboring, Ridge reaming tool, Ring expander, Scored cylinders, Telescoping gauge, Valve lapping, Valve refacing, Valve seat angle, Wear-in

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
7.1 Define terms		Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
7.2 List the major steps in disassembly of four-cycle engines		Foundation	Writing	Summarizes written information [1.6.17] Uses technical words and symbols [1.6.20]
		Thinking	Reasoning	Extracts rules or principles from written information [4.5.4] Sees relationship between two or more ideas, objects, or situations [4.5.5] Uses logic to draw conclusions from available information [4.5.6]

CAREER AND TECHNICAL SKILLS What the Student Should Be Able to Do		ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
7.3 List the major steps in reassembly of four-cycle engines	7.3.1 Demonstrate the ability to overhaul a four-cycle engine, including the following activities: cylinder resizing, valve grinding, valve seat refacing, and valve guide rebushing	Foundation	Speaking	Asks questions to obtain information [1.5.4]
				Interprets nonverbal cues, such as eye contact, posture, and gestures, for meaning [1.5.6]
		Thinking	Problem Solving	Devises and implements a plan of action to resolve problem [4.4.3]
				Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]
				Identifies possible reasons for problem [4.4.6]
				Recognizes/Defines problem [4.4.8]
				Revises plan of action indicated by findings [4.4.9]
				Tracks and evaluates results [4.4.10]
			Seeing Things in the Mind's Eye	Imagines the flow of work activities from narrative descriptions [4.6.1]
				Visualizes a finished product [4.6.4]

Glossary

Unit 1: Small Engines in Agriculture

1. ATV—all-terrain vehicle
2. Carbon monoxide—a colorless, odorless, and poisonous gas formed by incomplete combustion; chemical formula is CO
3. CDE—Career Development Event
4. EETC—Engine and Equipment Training Council; an organization that creates the voluntary technicians certification tests for outdoor power equipment technicians, mechanics, and service managers
5. Entrepreneur—a person who owns his/her own business
6. ESA—Engine Service Association; works in conjunction with EETC to promote the improvement of the outdoor power equipment industry
7. Federal Clean Air Act—an act aimed at ridding the atmosphere of harmful road vehicle emissions; since its inception, there has been an increase of awareness of the hazards of harmful emission from small gas engines
8. Fire extinguishers—should be in all shop areas; should be selected on the basis of the flammable materials that may be present for a specific fire class
9. Flammable—capable of burning
10. Flash point—the temperature at which an oil will ignite and burn
11. Four-cycle engine—also known as Otto cycle; a rapid combustion occurs every other revolution of the crankshaft; a cycle is considered a half revolution of the crankshaft; the cycles (strokes) are (1) intake; (2) compression; (3) power; (4) exhaust
12. General manager—a person who manages a small engine sales and service business
13. Hydrogen gas—a colorless odorless gas that is a byproduct of wet cell battery chemical reactions; explosive if ignited in enclosed spaces
14. Lawn garden and field equipment—Includes items of equipment such as lawnmowers, rotary tillers, chainsaws, line trimmers, garden tractors, generators, high-pressure sprayers, air compressors, concrete mixers, irrigation pumps, leaf blowers, and others
15. LPG—liquid petroleum gas; made usable as a fuel for internal combustion engines by compressing volatile petroleum gases to liquid form

16. OPE—outdoor power equipment
17. OSHA—Occupational Safety and Health Administration
18. Personal watercraft—a type of popular small boat that is propelled and guided by a high velocity jet of water
19. Rotary mower—a lawnmower that has horizontally rotating, large diameter blades and heavy engines and housings
20. SAE—Supervised Agricultural Experience that agriculture students operate to give them hands-on experience
21. Sales manager—personnel needed in the small gas engines business to sell or rent implements and vehicles
22. Sales representative—personnel who works closely with the service manager and mechanics in the field to catch and correct chronic service problems
23. Service manager—personnel who is responsible for quality workmanship and satisfactory shop operations
24. Service technician—personnel with skills to use tools, materials, and machine processes to produce a special part or engine unit
25. Solvent—a solution that dissolves some other material
26. Toxic fumes—vapors from burnt or nonburnt solvents or fuels that are poisonous or even deadly
27. Two-cycle engine—an engine that runs on an oil-gas mixture and fires on each revolution of the crankshaft; lighter, will operate in any position, and have fewer moving parts than the four-cycle engine
28. Ventilation—providing proper air circulation in a given area
29. Volatility—the tendency of a fluid to evaporate rapidly or pass off in the form of vapor

Unit 2: Small Engine Tools

1. Box-end wrench—a tool to loosen or tighten a nut or bolt where a 90-degree partial or full turn is available
2. Center punch—a steel punch with a hardened steel point to make depressions in metal surfaces before drilling
3. Compression gauge—a test instrument used to test compression in an internal combustion engine
4. Dial indicator—a precision instrument that is useful in measuring movement of various parts
5. Drift punch—a steel punch that is tapered and used to align holes in mating parts
6. Feeler gauge—a metal strip or blade finished accurately to thickness and used to measure the clearance between two parts
7. Flywheel holder—a tool used to hold the flywheel when torquing the crankshaft nut or clutch
8. Gear puller—a tool used to pull gears and bearing from shaft
9. Impact driver—a hand tool used to loosen nuts or tighten nuts and bolts by converting the force of a hammer blow to rotary motion
10. Impact wrench (air)—an air-powered tool used to loosen or tighten nuts and bolts
11. Machinist's vise—a tool used to hold parts while they are being worked on
12. Micro-depth gauge—a measuring device used to measure depths
13. Multimeter—a measuring instrument that is a combination of ammeter, ohmmeter, and voltmeter
14. Open-end wrench—a tool used to loosen or tighten a nut or bolt when it is not possible to encompass the bolt head or nut with a box-end wrench or socket
15. Pin punch—a steel punch of various diameters and lengths to drive straight pins, tapered pins, and roll pins in and out of holes
16. Prick punch—a steel punch with a 60-degree hardened point to make a small depression in metal prior to using a center punch
17. Probe and pick-up tool—helpful in locating and retrieving small parts dropped into small crevices where they cannot be reached with the hands or fingers
18. Retaining ring pliers—tools used to remove and install retaining rings on the shafts or in cylindrical holes

19. Ring compressor—a tool used to force the piston rings into their grooves so the piston can be pushed down into the cylinder
20. Screw pitch gauge—used to determine the number of threads per inch on bolts, screws, nuts, and in threaded holes
21. Standard micrometer—a precision instrument designed to accurately measure pistons, crankshafts, valve stems, and other small engine components; may be constructed with the outside or inside measurements accurately to .001”
22. Tachometer—a device for measuring and indicating the rotational speed of an engine
23. Telescoping gauges—used to gauge a distance and then transfer that distance to a micrometer for actual measurement
24. Torque wrench—a special wrench with a built-in indicator to measure the applied turning force
25. Vernier caliper—a measuring device used to measure both internal and external measurements
26. Vernier micrometer—a precision measuring instrument accurate to .001”
27. Valve spring compressor—a tool used to squeeze valve springs to release the keepers so springs can be removed

Unit 3: Engine Identification & Inspection

1. BDC—bottom dead center
2. Bore—the diameter of a hole, such as a cylinder; also, to enlarge a hole as opposed to making a hole with a drill
3. CID—cubic inch displacement
4. Combustion—the process of burning
5. Cycle—completion of a series of events to produce a power impulse
6. Friction—resistance to motion created when one surface rubs against another
7. Horizontal crankshaft—an engine operating position in which the crankshaft is in the horizontal position
8. Horsepower (HP or hp)—the energy required to lift 550 pounds a distance of one foot in one second
9. Kinetic energy—energy in motion
10. Model number—a numbering system that describes the basic engine but is manufacturer specific as to the information it provides
11. Piston displacement—the volume of air moved or displaced by moving the piston from one end of its stroke to the other
12. PSI—pounds per square inch; the most common unit for measuring pressure
13. Reciprocating motion—a back-and-forth movement, such as the action of a piston in a cylinder
14. Score—a scratch, ridge, or groove marring a finished surface
15. Service manual—a book that includes service procedures, explode views of assemblies and systems, and troubleshooting charts
16. Stroke—the distance moved by the piston as it moves from TDC to BDC or the reverse; half of a complete revolution
17. TDC—top dead center
18. Torque—an effort devoted toward twisting or turning
19. Transmission—important components of any tractor that transfers engine power to the ground to make a piece of equipment mobile

20. Vertical crankshaft—an engine operating position in which the crankshaft is in the vertical position

Unit 4: Principles of Operation of Four-Cycle Engines

1. Armature gap—the space between the legs of the armature and the flywheel magnets
2. Camshaft—a shaft containing lobes or cams that operate engine valves
3. Crankcase—the housing for the crankshaft and other related internal parts
4. Crankcase breather—a reed valve assembly that allows outward airflow only from the crankcase
5. Crosshatch—the correct pattern of marks on the cylinder walls created by the in-and-out motion of a cylinder hone
6. Exhaust stroke—the movement of the piston from BDC to TDC with the exhaust valve open to expel the spent fuel gases from the cylinder
7. Flywheel magnet—a piece of metal with magnetic properties embedded in the flywheel to establish a magnetic field around the winding of the coil
8. Governor—a mechanical, hydraulic, or electrical device that controls and regulates speed
9. Intake stroke—the piston movement from TDC to BDC with the intake valve open to allow the fuel air mixture to move into the cylinder
10. Oil sump—the part of the block in a small four-stroke engine that holds and collects the lubricating oil
11. Overhead valve system—a system by which motion is transmitted through push rods and rocker arms to open and close valves; increases fuel efficiency and improves engine service life
12. Piston ring—an expanding ring placed in the grooves of the piston to seal it against the passage of fluid or gas
13. Power stroke—the piston movement from TDC to BDC with both valves closed as the piston is caused to move by the combustion of the air mixture
14. Tappet—the engine component for transferring motion to cause valves to open and close
15. Timing marks—marks on camshaft and crankshaft gear that must be assigned for valve timing to be correct
16. Valve guides—bushings or holes in which the valve system is placed; only back-and-forth, two-way motion is allowed

Unit 5: Small Engine Systems

1. Babbitt—an alloy of tin, copper, and antimony having good antifriction properties, used as a facing for bearings
2. Centrifugal—a force that tends to move a body away from its center of rotation
3. Choke—a reduced passage, such as a valve placed in a carburetor air inlet to restrict the volume of air admitted
4. Condenser—a device for temporarily collecting and storing a surge of electrical current for later discharge
5. Conduction—the flow of electricity through a conducting body
6. Cooling fins—thin layers of metal surrounding the cylinder and flywheel that transfer heat from the engine by convection
7. Diaphragm carburetors—the difference between atmospheric pressure and the vacuum created in the engine pulsates fuel into the combustion chamber by a diaphragm
8. Dwell—the number of degrees measured around the cam from the point of closing to the point of opening
9. Ejection pump system—forces oil under pressure against the rotating connecting rod and other internal parts
10. Float needle valve—a valve controlled by the float to regulate fuel flow into the float bowl
11. Fuel pump—provides constant pressurized fuel flow to the carburetor
12. Hand primer—used to fill the float bowl or pump by manual control
13. Idle adjusting needle—regulates the amount of air mixing with the fuel in the idle orifice
14. Ignition coil—used in a magneto system that contains windings that create a high voltage to jump the spark plug
15. Solid state ignition (CDI)—breakerless electronic component that moves past the flywheel magnets to produce a spark
16. Spark plug reach—the distance the end of the plug is embedded in the top of the cylinder
17. Splash lubrication—a dipper is designed to pick up oil from the crankcase, splashing oil on various moving internal parts
18. Throttle valve—regulates the amount of air-fuel mixture entering the cylinder

- 19. Venturi—two tapering streamlined tubes joined at their small ends so as to reduce the internal diameter
- 20. Viscosity—the resistance to flow or adhesive characteristics of an oil

Unit 6: Troubleshooting

1. Air breather—air cleaners used to filter incoming air into the carburetor
2. Antifreeze—a liquid, such as ethylene glycol, that is added to water to lower its freezing point
3. Clearances—the distance or range (usually in thousandths of an inch) between engine parts
4. Compression test—a test to check the compression of an engine by measuring leakage from the cylinder to other parts of the engine
5. Condensation—moisture that collects on the inside of a container due to a temperature change
6. Crankcase breather—a filter element allowing outward airflow from the crankcase
7. Dipstick—a part used to check the oil level in an engine
8. Loaded oil—oil that cannot absorb any more contaminants and remain an effective lubricant
9. Muffler—a part designed to rid combustion gases from the engine and reduce noise
10. Orifice—an opening that restricts the passage of a fluid or gas
11. Preventive maintenance—tasks that must be performed regularly to keep an engine working properly
12. Stroboscope—an electronic unit used to check the rpm of an engine
13. Tolerances—specification limits of engine parts
14. Torque specifications—the specified tightness on a bolt or nut in feet/pounds or inches/pounds

Unit 7: Overhauling & Rebuilding the Four-Cycle Engine

1. Antifriction bearings—roller or ball bearings that reduce friction between moving parts
2. Cylinder gauge—a needle gauge that can determine the wear of a cylinder
3. Cylinder sleeve—an inner lining for a cylinder wall
4. Cylinder taper—the difference between the cylinder diameter below the ring travel and just below the ring ridge
5. End gap—the space between the opening of the rings when inserted into a cylinder
6. Friction bearings—precision inserts that do not rotate that line the inside rod and rod cap
7. Honing—using an abrasive honing tool to remove marks and surface fractures on the inside of the cylinder wall
8. Inside micrometer—a precision instrument used to measure the exact diameter on the inside of something
9. Lands—the full diameter ridges between the ring grooves
10. Overhead valve system—a system of push rods and rocker arms that open and close the valve
11. Reboring—removing or adjusting the cylinder wall to lesser diameter by using a cylinder bore
12. Ridge reaming tool—a tool used to remove the ridge from a cylinder
13. Ring expander—a specialized tool used to install or remove rings from a piston
14. Scored cylinders—a scratch, ridge, or groove marring a finished surface
15. Telescoping gauge—a gauge that is spring loaded to measure the inside of a cylinder
16. Valve lapping—using valve grinding compound and a valve lapper to polish or smooth the face of the valve
17. Valve refacing—resurfacing the valve face by means of an abrasive wheel
18. Valve seat angle—the angle at which valve seat has been cut (usually 45 degrees) to meet the valve face
19. Wear-in—the process in which the face of each ring wears off until it fits perfectly against the cylinder wall